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DECISION ENVIRONMENT: A PROPOSED PHYSICAL INSTALLATION.(U)

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DECISION ENVIRONMENT:
A PROPOSED PHYSICAL
INSTALLATION

Thomas Johnson

76-09-10

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Philadelphia, Pennsylvania

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Graphics Display
Decision Environment

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The decision Aiding Information Systems Project (DAISY), developed at the Decision Sciences Department of the Wharton School and sponsored by the Office of Naval Research, is constructing an environment to train managers to make tactical decisions more effectively and efficiently. The laboratory space will be used by several different types of decision makers, from individuals to classroom groups.

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It is intended for operational use assisting in the
actual performance of decision making tasks, for
educational use to instruct students and professionals
in decision aiding methodology, and in research for
extending the decision makers capabilities.   The
Decision Environment will be located in room E13 of
Dietrich Hall and will be staffed by graduate
researchers and teaching personnel.

1.   Physical Environment - Group Decision Environment

The total space for the Decision Environment is 35 by 20 feet and is divided into two smaller spaces (figure 1). The front area, or the Group Decision Environment, is built for large group presentations and is nearly 20 by 20 feet. Armchairs for seating 25 to 30 people are situated in the room. Two large screen projectors are at the front of the room to the left and right of the blackboards (fig. 2). The projectors are kept under the table at the front of the class. On top of the table a monitor and keyboard are placed for the leader's/teacher's control station.

The leader controls interaction with the computer via the keyboard while either viewing on his screen just the prompting messages or the exact images of what is on the screen. A "mouse" (see input devices below) can also be used on the table. The leader is free to move in front of the room without blocking the view of the screen or to write on the writing boards built at the same height at the screen. In addition slides and movies can be shown on a central screen. An overhead projector, properly shielded, can operate from the top of the projector table, or a tv camera can be used as a projector through the large screen display.

For multi-terminal presentations or demonstrations, terminals from the small room can be rolled in and placed next to the front desk. Telephone jacks, computer jacks, video jacks, and power outlets are placed in critical spots around the room.

The room will be air conditioned and will have light controls for proper illumination which will not interfere with the projector signals. Sound insulation will be provided in the rear room so this large room and the adjoining work room can be used separately from each other.

1.2 Individual Decision Environment

The back half of the Decision Environment serves as both an operational work area for two project members and as the decision environment for the projects which conduct research efforts in this area. The room, slightly smaller than 20 by 15 feet, contains four work areas, two terminal work stations and two standard desk areas, and storage space. The space for the individual Decision Environment is located immediately behind the Group Decision Environment and is connected via a door. It also has a separate entrance through adjoining office space. This makes this environment linked to but not restricted by the group area.

Two of the work stations will permanently house terminals which will be character display screens with keyboards. The other two work stations are primarily study

or preparation areas, but will, from time to time, have portable terminals or the terminal from the neighboring group room. All work stations will be equiped to support terminals.

The terminals will be scheduled by the facilities coordinator who will be assigned one of the work stations. Other project members will be assigned the remaining work stations. The terminals will be normally assigned on an "as needed" basis.

In addition to the work stations, the room will house computer control units, audio amplifiers, and project documentation files. The terminals we use require a control unit. The units will be kept in the room for ease of accesssecurity and ease of access by project staff. and security. The color display unit also requires a colorizer box and the terminal control unit which will be housed in the same general area. Finally, file cabinets for storing documentation will be maintained in this central location. These files will be supervised by the facility coordinator.

This area will be air conditioned and have numerous electric outlets for electronic equipment being used.

2.   Decision Environment Support System

An elaborate set of hardware and software supports the Decision Environment. Some of this is visible, but the majority exists in a remote support network. The software, i.e. DAISY software, is described in detail elsewhere, it will not be covered in this description. Instead, this section describes the hardware configuration that makes up the system, especially the newly acquired equipment for the Decision Environment.

2.1 Base System

The Decision Environment is based on an existing set of computer equipment in which the University has invested over the past few years. The systems centers around the DECSystem-10 computer on which DAISY has been developed. Until now the DECSystem-10 has provided the bulk of the computation and network services. The primary interface to the computer has been the G.P. 100 terminal where windows and alterters have been successfully demonstrated.

In the future, the DAISY system will be using some additional equipment at the University. Much of this equipment is already in the Moore School, and will be utilized through a network system now being built. Of particular importance is a high quality color graphics computer system which includes a Ramtek display and a PDP-11 computer. The display system currently can act as a remote display terminal to a host computer, and is currently

attached to the Moore School's Univac Series 70 System; to fully utilize the Ramtek as a DAISY terminal it must first be attached as a DECSystem-10 terminal and then additional equipment must be attached to bring capabilites to the decision environment. These additions are described later.

2.2   Ramtek

The Ramtek is a color video graphics terminal with moderately high resolution and elaborate color capabilities and the necessary video storage (figure 3). As a video frame buffer it can store a full video still picture and display it flicker-free with a resolution of 240 by 320 points in color or shades of grey. At each of the 240 by 320 picture points (pixels) the Ramtek has 12 bits of memory. The PDP-11 computer which drives the Ramtek can store values into any pixel point on the screen by storing values in the associated high speed memory. The values stored in the memory are scanned at video rates by a television speed logic unit and the codes are interpreted as a color or a grey scale by that unit. The video logic then turns the interpreted value into an actual tv color signal and the image is generated. The high speed video rate scan of memory goes on continuously and creates a television picture. Asyncronously the PDP-11 can change any pixel in memory thereby changing the picture dynamically.

The PDP-11 can change many pixel points simultaneous by using some of the higher level commands in the Ramtek logic. The Ramtek has hardware logic to display directly:

Characters

Vectors (i.e. lines)

Bars (i.e. Vertical + Horizontal rectangular masses)

Full Screen Single Color (Grey)

Blocks or Masses of Color (Grey)

The Ramtek logic unit simply takes a single command and enters the appropriate data values in the frame buffer memory locations, relieving the PDP-11 of the chore.

The interpretation of data coming out of the frame buffer can be altered with a few wiring changes. Currently it is set as shown in figure 4. Up to 255 possible levels of grey are produced by using the right most 8 bits for that scale. Sixteen levels each of red, green, and blue are produced by using 4 bits for each color. Of course there are 4095 possible colors available with this configuration; however the eye would have some difficulty detecting differences between many colors.

The PDP11 which drives the Ramtek is a very small buffer computer, with only 4K of memory, used primarily for communicating with the host processor, handling the data

compression task, servicing the attached teletypewriter, and handling the track-ball (mouse) located at the Ramtek. The track-ball is a large solid sphere enclosed in a casing with data entry pushbuttons. The ball can be rolled inside the casing to move the cursor on the screen. The cursor is used to point at, position, and draw objects. The PDP-11 can follow every movement of the ball, or it can let the operator press a button to mark a point, or it can do both.

3.   New Decision Environment Support System

To bring the capabilities of the Ramtek system to the DAISY system we could either build the Decision Environment physically near the Ramtek or functionally bring the Ramtek to the Decision Environment. We chose to do the latter, electronically. Since the Ramtek is a video terminal with computer links, we are treating it as a remote unit, cabling both the video and the computer connections to the decision environment. In this way the unit serves its display functions to both the Moore School and the Decision Environment.

Figure 5 shows the additional equipment now being installed in the decision environment. Figure 6 lists brief descriptions of this equipment. All those items with an arrow attached are being purchased for the project.

3.1   User Equipment

Some portion of this equipment will be physically located in the environment itself for direct use by the user.

The most prominent additions are the two Advent Videobeam Projectors; one will normally be situated in the Group Decision area and the other in the individual area. Note that the unit in the individual area can easily be

moved to the group area for side-by-sdie presentation. An Advent is a color television projector with a 7 foot diagonal screen specially designed for seated-audience viewing. One projector will normally display the full color Ramtek images; the other projector will normally display in color, the associated text.

The projector can also be used with the regular black and white monitors by employing a simple video patch cord, so it can be serving a multitude of devices types. Its primary use is as a display for large audiences. This will include support of both large group decision efforts and of teaching.

A color monitor will also be purchased to serve as a single-user display device. It will normally be attached to the character display, but much like the projector will serve multiple devices. It can even be used as a black and white monitor to the conventional terminals.

A character display terminal with keyboard will be installed to permit access to the remote Ramtek unit. This terminal, an ADDS 460, will serve as a console to the Ramtek/PDP-11 configuration even though it is located 1/4 miles away. The ADDS 460 is a teletype replacement with three major enhancements. First it is a display terminal driving a television monitor. Second it has limited graphics capabilities, and can display pictures with resolution of 160 by 72 pixels using special graphics

characters. Finally, it has a limited color capability. It can display graphics or characters in any selection of 7 preset colors. The ADDS produces a red, green, blue video signal which can be plugged into studio monitors.

The ADDS terminal will be used to display characters, images which are low resolution, and images which require only fixed color representations. No real color or "real life" images could be displayed on the ADDS. Bar charts, time series plots, rough diagrams, and standard character text are typical displays for the ADDS. Character displays in color are easily readable and will find the most frequent use on this unit, primarily because the unit is more suited to text display than is the Ramtek. The Ramtek character set is so large that less than 40 characters fit across the Ramtek screen, while 80 fit on the ADDS. With the 24 displayable lines this terminal is well suited for color character graphics.

The ADDS, the Ramtek plus the other two existing G.P. 100 terminals yield four terminals in the Decision Environment, with three individual keyboard/displays plus large screen displays driven by the Ramtek and ADDS.

One additional input device under construction is the "mouse". The mouse is logically equivalent to a track ball except that instead of rolling the hand over the ball the mouse is rolled over the table. The mouse has an ball embedded in place of its its legs. The body of the mouse,

big enough to fit in the palm of the hand, is grasped and rolled over the table. Buttons are placed along the "nose" of the mouse, so the user can signal a data entry point to the computer. Its "tail" the cable running to the terminal sends position signals back to the computer. Like the trackball the mouse is used for pointing at, moving, and drawing objects.

Finally, a VOTRAX voice synthesizer will be installed to provide the Environment with voice alerting and voice based interaction. The synthesizer will normally be attached to the G.P. terminals but they can be easily configured with the other units. Using a small audio amplifier, the voice signal can be adjusted for headsets, the individual Decision Area or the Group Decision Area. The voice synthesizer receives phonetic character representation from the DAISY software and produces synthesized speach.

3.3   Computer Network Equipment

To connect the remote user equipment, a set of computer network units are being added. The hardware of the environment acts as a remote unit to two computers the DECSystem-10 and the PDP-11. The standard character terminals like the G.P. 100 will continue to interact with the DECSystem-10, while the ADDS graphics terminals will be

connected via the Ramtek's PDP-11. In both cases interconnection will be through the University's GANDALF Network.

The Gandalf nodes permit switched interconnection between terminals and computers. In the Decision Environment we will install three terminal interconnection nodes. Two nodes would normally connect with the DEC-10 and one would connect with the PDP-11. At the DEC-10, nodes are already installed. At the PDP-11 we must add Gandalf nodes. We will add to the Ramtek's PDP-11 one network node to connect the Decision Environment's terminals and one network node to connect the PDP-11 to the DECSystem-10. This configuration makes the Decision Environment's ADDS act as unit a terminal to the Ramtek/PDP-11, and the PDP-11 becomes in turn the terminal to the DEC-10.

Software has been written to allow the ADDS user to connect with the Ramtek and then have the Ramtek pass input from the ADDS on to the DECSystem-10. Data that comes back out of the DECSystem-10 directed towards the ADDS is checked by that software for special switching characters. The appropriate characters indicate that data is to be displayed on the Ramtek; otherwise it is passed on to the ADDS using the PDP-11 simply as a message routing unit. Those characters switched to the Ramtek are used to draw pictures on the screen. The switching back and forth to draw pictures is handled at the applications program end by a set

of subroutines for the DECSystem-10. A program that runs on the DECSystem-10 can be run without problems through the Ramtek. By adding the necessary subroutine calls that program can generate pictures on the Ramtek along with its prior functions.

3.4   Video Network

To bring the Ramtek picture from the Moore School, 1/4 mile away, to the Decision Environment requires the laying of video cable between those two locations and installation of the necessary amplifiers and equalizers. A technical brief is included, the following refences (e.g. D1) refer to figures 3 & 5.

First the Ramtek needs a special clock (t1) to make it NTSE 170 compatible. This makes the Ramtek run at the standard television frequency. The Ramtek generates three separate Red, Green, Blue (RGB) signals on three separate plugs which drives special monitors. An RGB-to-composite converter (C2) changes that single signal to composite video, not unlike the signal broadcast by tv stations. This composite signal is ready to be transmitted to the Wharton School, using a line driver/amplifer to minimize noise and distortion.

Finally, the video signal is sent over a cable to the Decision Environment. There, an equalizer is tuned especially for the cable to eliminate distortion and noise. Within the Environment the cable is connected to both the color Monitor (D1) and the Projector (D2).

3.5   PDP-11

Additional computer rack space must be provided to fit the new interface cards. (P2,P3) This includes interconnecting cable and power supplies. The PDP-8 is loaded with the additional software, so more memory must be obtained. The addition of 8k of memory (P1) extends the total size to 12k. This is still a small system and could not support the Ramtek stand-alone in most applications. However, the added space does allow enhancement and powerful local functions like curve filling and mouse tracking.
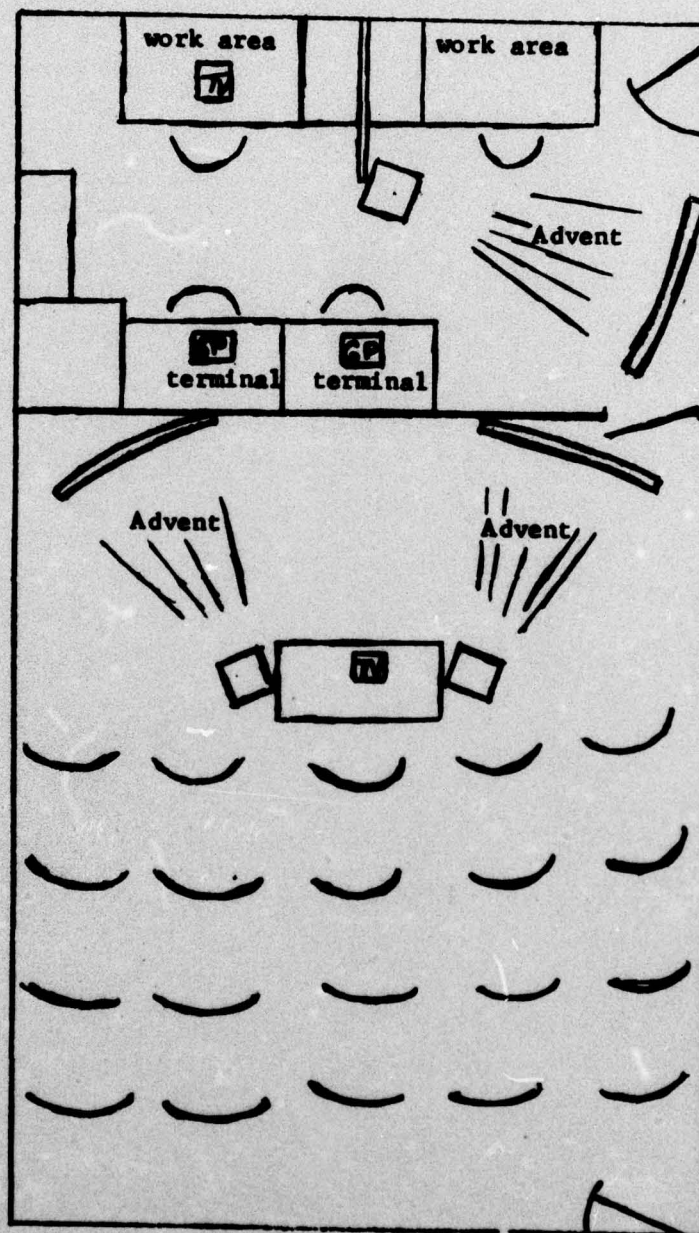
3.6   Mouse

A mouse (I2) is being constructed on campus to serve as the interaction device. As part of the mouse a special serial interface (I3) is being built for the ADDS.

The mouse is a simple device with 2 degrees of freedom. It operathes with te PDP-11 in a very simple fashion. As the mouse is being rolled a commutator sends out a pulse

every 2 degrees. The mouse logic immediately sends a character through the special serial interface. The PDP-11 counts the characters sent and moves a curser the approriate number of points. When the button is pushed a different special character is sent.

INDIVIDUAL
DECISION
ENVIRONMENT

work area

work area

TV

terminal
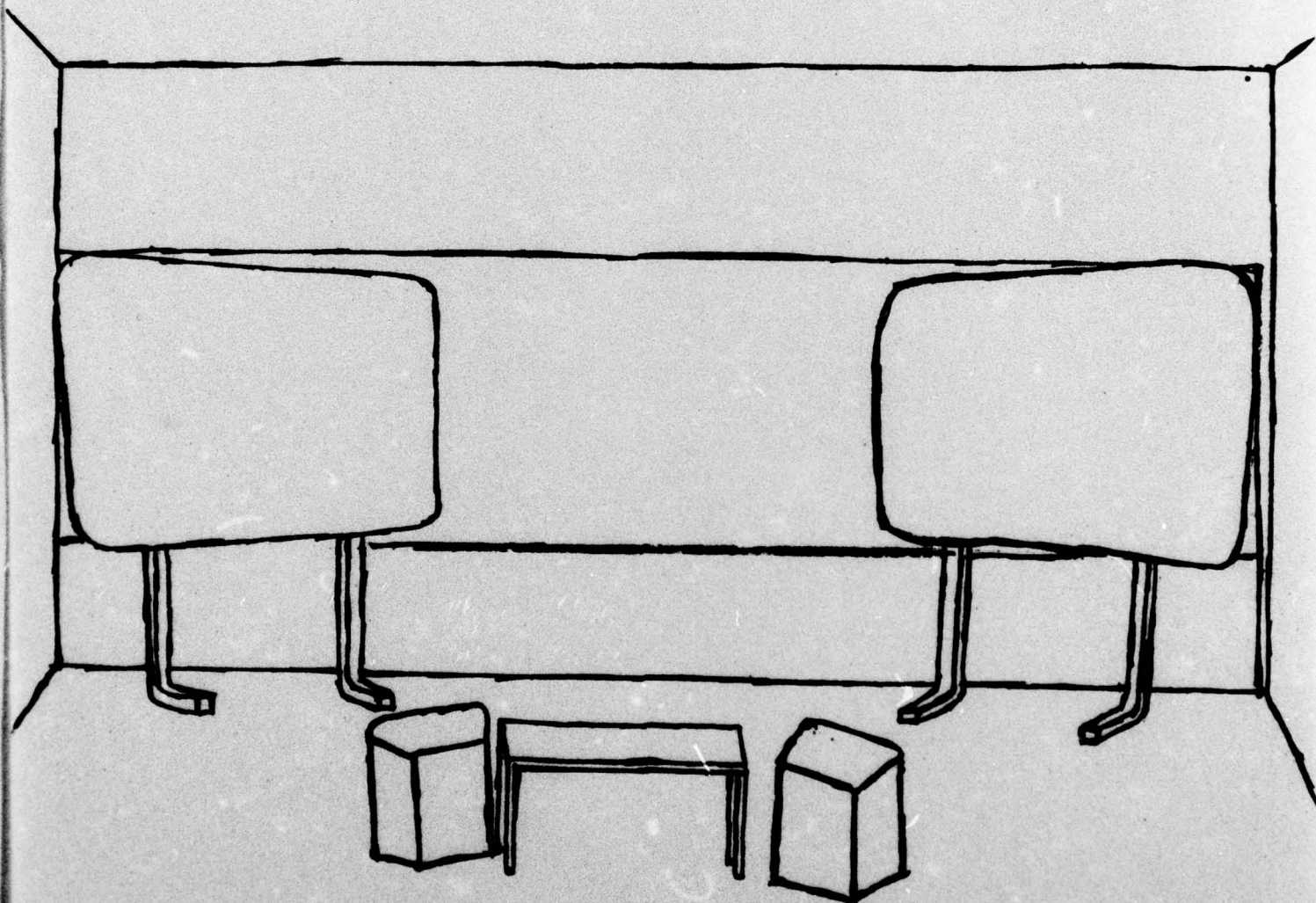
terminal

Advent

GROUP
DECISION
ENVIRONMENT

Advent

Advent

TV

Figure 1

Figure 2

DECISION ENVIRONMENT EQUIPMENT

(Figure 3)

DISPLAY UNITS

d1 7' Advent Videobeam Color T.V. Projector and Screen
d2 17" Sony Trinitron Color T.V. Monitor
d3 7' Advent Videobeam Color T.V. Projector and Screen(t)

INPUT UNITS

i1 ADDS keyboard
i2 Mouse

TERMINALS

t1 Ramtek Video Generator Crystal Assembly
t2 ADDS Consol 460 Limited Graphics/Character Unit
t3 Data Switch Interface for ADDS and Mouse

NETWORK CONNECTIONS

n1 Gandalf Interconnection Unit and Line Driver (ADDS)
n2 Gandalf Interconnection Unit and Line Driver (PDP-11)
n3 Gandalf Interconnection Unit and Line Driver (PDP-11)
n4 Gandalf Interconnection Unit and Line Driver (DEC-10)

VIDEO CONNECTIONS

v1 75ohm to 124 ohm Head End Dynaire BU-229
v2 124ohm video balanced cable 16 gauge solid copper
v3 124ohm to 75 ohm Equalizer Dynaire EQ-270a

COLOR CONVERTERS

c1 RGB to Composite Video Converters (ADDS)
c2 RGB to Composite Video Converters (Ramtek)

PDP-11 ENHANCEMENTS

p1 8K Core Memory
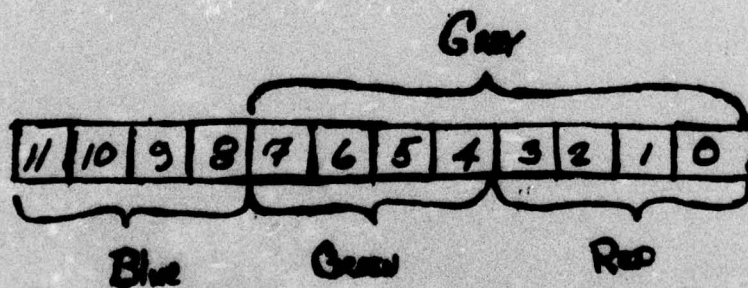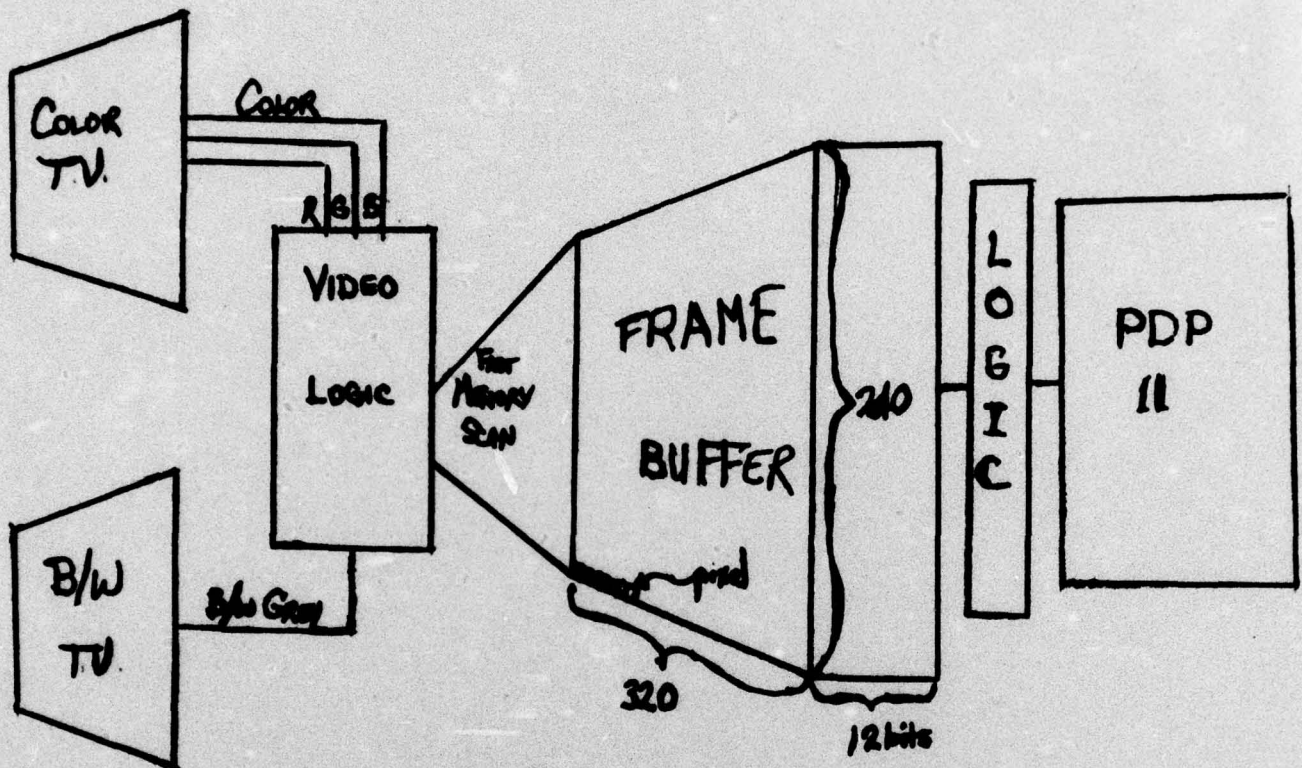p2 Serial Interface (ADDS)
p3 Serial Interface (DEC-10)
    Rack
    Rack Connection

Figure 4

DECISION ENVIRONMENT
(Figure 5)